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# *the* BOLL WEEVIL

## *how to control it*

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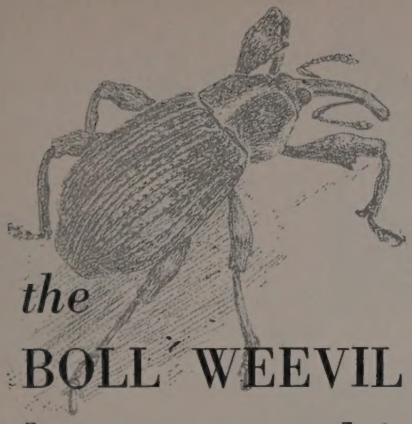

# *the* BOLL WEEVIL *how to control it*

The boll weevil [1] does more damage than any other cotton pest in this country. Since its entry into southern Texas in the 1890's, it has destroyed several billion dollars' worth of cotton.

This insect occurs in all the cotton-producing States except New Mexico, Arizona, Nevada, and California.

You can control the boll weevil by following good cultural practices and by applying insecticides. The use of insecticide should be considered supplemental to the essential cultural practices.

## DEVELOPMENT

The boll weevil has four stages in its life cycle—egg, larva, pupa, and adult. Under favorable conditions, it completes the cycle in 2½ to 3 weeks. High temperatures and humidity speed the cycle; low temperatures slow down development. As many as seven generations may develop in a year in the extreme southern part of the Cotton Belt.

The adult boll weevil is 1/8 to 1/3 inch long. It ranges in color from tan to dark gray, or sometimes to dark brown.

Starting in spring, the female lays eggs singly in cotton squares. When the boll weevil population is high and

C. I. 6524

Adult boll weevil; side and top views.

[1] *Anthonomus grandis.*

C. I. 6521

Cotton plant attacked by boll weevils: *A*, Hanging dry square, destroyed by weevil; *B*, flared square, with weevil punctures.

there is a shortage of squares, two or more eggs may be laid in one square. Late in the season, eggs are laid both in squares and in young bolls.

Eggs hatch in 3 to 5 days. The larvae feed 7 to 12 days inside the squares or bolls, then change into pupae. The pupal stage lasts 3 to 5 days. Adults develop from the pupae and cut their way out of the squares or bolls. After feeding 3 to 7 days, and mating, females begin laying eggs. The cycle is repeated until the cotton plants are killed by cold weather.

Adult boll weevils hibernate near cottonfields—in woods, along ditch banks, and in trash and litter around gins and farm buildings. In the spring they return to the cottonfields.

## DAMAGE

By means of jaws at the end of its snout, an adult weevil eats into a square or boll. Two types of punctures result:

*Feeding punctures* are made both by males and by females.

*Egg punctures* are made by females as places in which to lay eggs. They are deeper than feeding punctures.

Both types of punctures cause damage. After a square is punctured, the bracts around it flare; the square turns yellow and usually drops to the ground.

Many punctured small bolls drop to the ground. Punctured large bolls usually remain on the plant, but if they have egg punctures they will be damaged by the weevils developing in the locks where the eggs were laid. Weevil-infested locks produce no cotton or they produce a little that is of inferior quality.

## CULTURAL PRACTICES

One of the aims of cultural control is to reduce to the minimum the number of boll weevils that survive after harvest and go into hibernation.

In areas where cotton can be harvested before frost, the best single way to carry out this aim is to destroy cotton stalks early in the fall—as long before frost as possible. If this is practicable in your area, plan early harvest and early destruction of stalks. Select a rapid-fruiting, early-maturing variety of cotton that is suitable for your locality.

In areas where cotton must be harvested after frost, control of the boll weevil by destruction of stalks is not practicable. In these areas, comparable results can be obtained by using chemical defoliants and desiccants, which check plant growth and remove leaves and immature fruit.

C. I. 6521

Cotton boll, sectioned, showing attacking weevil, and weevil larva in its cell.

Anything you do to eliminate hibernation quarters will aid in control. Do these things:

- Practice clean cultivation.
- Plow ditch banks and turn rows in the fall.
- Remove weed clusters, particularly briars and vines, in pastures near cottonfields.
- Remove dense undergrowth from nearby woods. Follow forestry practices recommended by your district forester.
- Destroy litter around farm buildings.

Encourage neighboring growers to join with you in preventing hibernation of boll weevils.

Other cultural practices that aid in control are:

- Arranging for all growers in an area to start planting on approximately the same date.
- Planting the varieties of cotton that are recommended for your locality.
- Planting on land that is not adjacent to dense woods or other places favorable to hibernation.

Full-grown boll weevil larva (grub).

## CONTROL WITH INSECTICIDES

Where cultural practices do not provide satisfactory control, insecticides are the only effective weapon against the boll weevil.

### Seasonal Patterns

Generally, insecticide control of the boll weevil follows one of two patterns—(1) early-season control or (2) midseason or late-season control. Sometimes, both early and late treatments are required.

#### *Early-season control*

The purpose of early-season control is to kill as many as possible of the boll weevils that return to cottonfields from hibernation quarters, and to do it before the females lay eggs.

The period of insecticide treatment coincides with the period during which boll weevils are returning to cottonfields. Make the first application when the first squares are in the pinhead stage. Make two or three additional applications at weekly intervals. The last of this series of applications completes early-season control; and if all has gone well, few boll weevils have lived long enough to lay eggs. A follow-up inspection of the fields is advisable, for one or more of the treatments may have been poorly timed, or the spray or dust may have been improperly applied. Make additional applications if you find damaging infestations.

In some years, early-season control will protect the crop from serious injury until most or all of the bolls are

set. It is possible for a grower to achieve this result by independent effort, but each grower can increase his chance of success by making his effort a cooperative one. Like control through cultural practices, early-season application of insecticide is more effective if it is carried out cooperatively by cottongrowers in a large area. Encourage other growers in your community to participate in a program aimed at holding down the boll weevil population during the early weeks of fruiting.

When boll weevil damage is kept to a minimum during the early fruiting period, there is a more uniform setting of bolls, and higher-quality cotton results. Yields usually are higher because there is less likelihood that the insect will get out of hand in midseason or late season.

Early-season control has special value in areas where droughts often occur in the late summer, and all the cotton must be set early in the season. It is also important where the boll weevil is a serious problem every year.

### *Midseason or late-season control*

The need for midseason or late-season control is determined by making an infestation count. Insecticides are not applied until inspections show that the crop is actually being damaged.

*Making an infestation count.*—In a field of 5 acres or less, determine the percentage of infestation as follows:

C. I. 13809

Adult boll weevil with wings spread.

Walk diagonally across the field and pick 100 squares, one-third grown or larger. Pick squares equally from the top, middle, and lower branches. Do not pick squares from the ground. Do not pick flared or dried-up squares that are hanging on the plant.

Count the number of squares that have boll weevil punctures. This number is the percentage of infestation.

If your field is larger than 5 acres, make additional counts—approximately one count for each 5 acres.

*When to apply insecticide.*—On soils in which cotton tends to set the crop early and cut out, start applications when 10 percent of the squares are punctured. On heavier soils in which the plants fruit over a longer period, and where potential production is high, start applications after 10 percent—but before 25 percent—of the squares are punctured.

Repeat applications every 5 days until the infestation level drops below the recommended starting level, or until the crop is mature. When the boll weevil population is heavy, it may be necessary to reduce the interval between applications to 3 or 4 days. If an application is washed off by rain, repeat it as soon as possible.

## Selecting Insecticides

Recommendations for selecting insecticides to control the boll weevil vary in different States. Every year, the extension service in each State issues a detailed guide for the control of cotton pests. You can obtain the guide from your county agricultural agent or State agricultural college. Follow it when you select insecticides.

The boll weevil has developed resistance to some insecticides in some areas. Your selection of an insecticide should be based on whether it has developed resistance in your area; if you are in doubt, consult your county agent. Generally, if control has been satisfactory with the insecticide you have been using, resistance to it has not developed.

Poor applications, rather than re-

TABLE 1.—*Concentrates for preparing sprays, and rates at which they are applied*

| Insecticides (as emulsifiable concentrates) and strength [1] | Amount of emulsifiable concentrate to be added to water to treat 1 acre [2] | |
|---|---|---|
| | Early-season or midseason control | Late-season control |
| CHLORINATED HYDROCARBONS | | |
| | *Pints* | *Pints* |
| Aldrin, 2 pounds per gallon | 1 to 2 | 2 to 3 |
| BHC (gamma isomer), 0.9 pound per gallon | 3 to 3½ | 3½ to 4 |
| Dieldrin, 1.5 pounds per gallon | ⅝ to 1¾ | 1¾ to 2⅝ |
| Endrin, 1.6 pounds per gallon | 1 to 1¾ | 1¾ to 2½ |
| Heptachlor, 2 pounds per gallon | 1 to 2 | 2 to 3 |
| Strobane, 6 pounds per gallon | 2⅔ to 4 | 4 to 5⅓ |
| Toxaphene, 6 pounds per gallon | 2⅔ to 4 | 4 to 5⅓ |
| ORGANIC PHOSPHORUS COMPOUNDS | | |
| Guthion, 1.5 pounds per gallon | 1⅓ to 2 | 2 to 2⅔ |
| Malathion, 5 pounds per gallon | 1⅔ to 2½ | 2½ to 3⅓ |
| Methyl parathion, 2 pounds per gallon | 1 to 2 | 2 to 3 |

[1] Strength is stated in number of pounds of active ingredient per gallon of emulsifiable concentrate; these are the usual commercial formulations. If you buy an emulsifiable concentrate of a strength different from that stated in the table, use proportionately more or less of it.

[2] For bollworm control, add ½ pound of DDT emulsifiable concentrate to sprays prepared from any of the insecticides named in this table, except endrin.

sistance, are often responsible for unsatisfactory control. Be sure that applications are made as recommended in your State guide. If you then fail to get control, ask your county agent for advice.

*Where there is no resistance*

If boll weevils in your area are not resistant to insecticides, use any of those listed in tables 1 and 2.

*Where there is resistance*

If boll weevils in your area are resistant to insecticides, you can use one of the organic phosphorus compounds, or calcium arsenate, or Sevin (see tables 1 and 2). Or you can use a mixture of 2 parts toxaphene and 1 part DDT, or 2 parts Strobane and 1 part DDT.

When used for boll weevil control during midseason or late season, any of the insecticides listed in tables 1 and 2 (except endrin, calcium arsenate, and Sevin) should have DDT added as a precaution against bollworm buildup. Mixtures containing DDT are generally more effective against the boll weevil also.

## Applying Insecticides

Any insecticide in the accompanying tables may be applied in either a dust or a spray. However, most spray formulations of calcium arsenate or Sevin have been difficult to apply.

Sprays or dusts may be applied with either ground machines or airplanes. Early-season applications are more effective when ground machines are used. Midseason or late-season applications are equally effective when made with ground machines or airplanes.

Rates of application suggested in the tables cover a wide range to include amounts recommended by various States. Consult your State guide for amounts to use in your area.

*Dusts*

If you are applying dust with ground equipment, use one nozzle for each row; set nozzles 6 to 10 inches above tops of the plants.

If applying dust by airplane, limit the swath width to the plane's wingspan, or not more than 40 feet.

Dust applications usually are more effective if made in early morning or late afternoon.

Do not apply dust when wind velocity exceeds 4 to 5 miles an hour.

*Sprays*

Spray materials for use on cotton are usually formulated as emulsifiable concentrates. When mixed with water, they form emulsions that are easily applied with ground machines or airplanes. Sprays of calcium arsenate or Sevin are made from liquid suspensions or wettable powders of these materials; usually they have been difficult to apply with the kinds of sprayers generally used for cotton insect control.

When you use a ground machine, one properly adjusted nozzle per row will put enough spray on plants in the presquare and early fruiting stages to give control. When the plants are

larger, use two or three nozzles per row. These should be adjusted in such manner as to provide thorough coverage of the plants by the spray.

Before preparing a spray to be applied with a ground machine, you should know the per-acre discharge rate of the machine. This information enables you to mix the emulsifiable concentrate and water in the proper proportion. Example: If you are spraying with aldrin for late-season control, and your machine has a discharge rate of 3 gallons per acre, you should add between 2 and 3 pints of aldrin concentrate to enough water to make 3 gallons total of spray per acre (see table 1).

TABLE 2.—*Dusts, and rates at which they are applied*

| Insecticides (as dusts) and strength[1] | Per-acre rate of application | |
|---|---|---|
| | Early-season or midseason control | Late-season control |
| CHLORINATED HYDROCARBONS | | |
| | *Pounds* | *Pounds* |
| Aldrin, 2.5 percent | 10 to 20 | 20 to 30 |
| BHC (gamma isomer), 3 percent | 10 to 12 | 12 to 15 |
| Dieldrin, 1.5 percent | 10 to 20 | 20 to 33 |
| Endrin, 2 percent | 10 to 17 | 17 to 25 |
| Heptachlor, 2.5 percent | 10 to 20 | 20 to 30 |
| Strobane, 20 percent | 10 to 15 | 15 to 20 |
| Toxaphene, 20 percent | 10 to 15 | 15 to 20 |
| ORGANIC PHOSPHORUS COMPOUNDS | | |
| Guthion, 2.5 percent | 10 to 15 | 15 to 20 |
| Malathion, 10 percent | 10 to 15 | 15 to 20 |
| Methyl parathion, 2.5 percent | 10 to 20 | 20 to 30 |
| OTHERS | | |
| Calcium arsenate, 100 percent | 7 to 10 | 10 to 15 |
| Sevin, 10 percent | 10 to 15 | 15 to 20 |

[1] Strength is stated in percentage of active ingredient in the dust; these are the usual commercial formulations. If you buy a dust of a strength different from that stated in the table, use proportionately more or less of it.

NOTE.—Most commercial formulations of the above dusts (except endrin, strobane, toxaphene, calcium arsenate, and Sevin) also contain 5 percent of DDT for bollworm control. Many dusts contain 40 percent of sulfur to suppress spider mite infestations.

Almost all cotton spraying is done with low-gallonage sprayers. The amount of spray dispensed is usually between 1 and 3 gallons per acre. However, on rank cotton, in late season, it may be necessary to increase the amount up to 5 gallons per acre to get the desired plant coverage.

Spray applied by airplane is usually mixed to have a higher percentage of actual insecticide than spray applied by a ground machine. The greater concentration reduces the total amount of spray that must be applied from the air, and thus reduces application cost. In many areas, only 1 gallon of spray is applied per acre. When plant growth becomes rank, however, 2 or 3 gallons per acre may be needed for adequate coverage. When applying spray by airplane, limit the swath width to the plane's wingspan. Do not apply spray by airplane when wind velocity exceeds 15 miles per hour.

## PRECAUTIONS

**Insecticides are poisonous to man and animals. Handle them with care. Follow directions and heed all precautions on container labels.**

If you get insecticide on your skin or clothing, remove clothing immediately and bathe with soap and water. As soon as you have finished using insecticide, bathe and change to clean clothing.

Do not open containers in closed rooms. Do not leave metal containers of emulsifiable concentrates in the sun.

Empty containers are particularly hazardous. Empty bags should be burned *in the open*, or buried. Liquid containers should be crushed and buried.

Protect food and feed crops from the drift of insecticides being applied for boll weevil control.

Do not kill honey bees and other pollinating insects; make insecticide applications, if possible, during hours when bees are not visiting the plants. Avoid drift of insecticide into bee yards and adjacent crops in bloom. Notify beekeepers at least 48 hours before dusting or spraying, so that measures can be taken to protect the bees.

To protect fish and wildlife, be careful not to contaminate streams, lakes, or ponds with insecticides. Do not clean spraying equipment, or empty excess spray material, near such water.

Do not assume that your cotton is free of other injurious insects because you are effectively controlling the boll weevil. Insecticide applications to control the boll weevil often create conditions favoring rapid increase of certain other cotton pests later.

The cotton aphid, for example, may cause serious damage following applications of calcium arsenate or mixtures of some chlorinated hydrocarbons. Spider mites are more likely to build up to damaging numbers following applications of the chlorinated hydrocarbons. The seriousness of the bollworm problem varies from year to year; often it becomes acute after applications of insecticides to control other cotton pests.

Inspect your field at least once a week. If you find that other pests are becoming more numerous, follow recommendations in your State guide, or consult your county agent.